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THE DASHEEN, A ROOT CROP FOR THE SOUTH.¹

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INTRODUCTION.

While Mr. O. W. Barrett was connected with the Porto Rico Agricultural Experiment Station previous to 1905, he brought together and grew a large collection of the tuberous-rooted aroids which are important food plants of the Tropics. He drew attention to the possibilities of these aroids in a bulletin published in 1905,² and when he entered the Office of Foreign Seed and Plant Introduction he assembled a still larger collection from different parts of the world. Several field trials of these root crops were made at Gotha, Fla., and Gough, S. C. The results of these early experiments in the United States were published in 1910.³

As a result of these preliminary trials, in which, naturally, many of the introduced varieties failed, one of the forms, the dasheen, proved to be of unusual promise.

This paper deals with some of the more important features of the field experiments with the dasheen under the writer's direct supervision, as well as some greenhouse experiments in the production of blanched shoots, and with the results of many experiments in the cooking and preparation of the shoots and tubers for the table.

In 1909, from a small experimental plot grown near Charleston, S. C., it became apparent that the dasheens, which are closely allied to the taros of Hawaii, China, and Polynesia, were well adapted for culture in certain of the moist lands of the South. Since that time the endeavor has been to propagate a stock of the best varieties

¹ This circular is a revision and extension of the paper entitled "The dasheen, a root crop for the Southern States," which was issued in Circular 127 of the Bureau of Plant Industry, "Miscellaneous Papers," on May 17, 1913.

² Barrett, O. W. The yautias, or taniers, of Porto Rico. Porto Rico Agricultural Experiment Station, Bulletin 6, 27 p., 4 pl., 1905.

³ Barrett, O. W., and Cook, O. F. Promising root crops for the South. U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 164, 43 p., 1910.

sufficient to make possible their distribution on a large scale. Certain varieties secured originally from the island of Trinidad and other parts of the West Indies were found to be satisfactory in yield and to be of higher quality than others in the collection. These are the varieties to which particular attention is now being given, though many others are under investigation.

The origin of the word "dasheen" is somewhat obscure, but Mr. Barrett, who has spent some time in Trinidad as well as in other parts of the West Indies, states that it originated in Trinidad and that it was probably derived from the French phrase "de la Chine" or "da Chine" (the latter, pronounced dah-sheen, being the form in the patois of the French West Indies), meaning "from China." This opinion has been confirmed by other investigators.

The dasheen is also known in various parts of tropical America under the names "malanga," "eddo," "coco," "taya," and "tanier" (also spelled "tannia" and "tanyah"). These names are likewise often applied to the yautia (an aroid with sagittate leaves) and to the taro.

DESCRIPTION.

The dasheen and other plants mentioned are members of the botanical family Araceæ, to which belong also the calla, the Indian-turnip, and the caladium, or elephant's-ear. The dasheen and the taro belong to the genus *Colocasia*. The dasheens, which probably include two or more species, may be regarded as representing one of the general types of the taro. It is singular that a crop so important in many parts of the world and one that has been cultivated from prehistoric times should not have received a greater amount of careful study at the hands of modern botanists. From studies now being made, however, of a large number of varieties of this group in the collection of the Department of Agriculture, it is expected that the uncertainty with regard to the species involved will soon be largely cleared up.

The leaves of the dasheen are shield shaped (Pls. I and II), somewhat like the caladium and the tanier of the South, and contain the same acrid principle that characterizes the Indian-turnip and most other plants of that family. They should never be tasted raw. The tubers of the most promising Trinidad varieties are free from this acidity even in the raw state, but because of the possibility of tubers of an acrid variety being mixed with these it is best never to taste them uncooked. In cases of the accidental tasting of acrid tubers or leaves, lemon juice in a little water is found to alleviate the ill effects.

If dasheens are handled in water in scraping or paring them for cooking, a level teaspoonful of sal soda should be added to each quart of water. The outer part of the tubers contains an irritant that causes the hands to sting in somewhat the same way as the mouth and throat from the eating of raw acrid leaves or tubers. The hands are affected



A 5-ACRE FIELD OF DASHEENS, AS IT APPEARS IN OCTOBER.

These broad-leaved plants when full size shade the ground completely. The seed tubers are planted in March; harvest takes place in October or November. This planting is on hammock land near Brooksville, Fla.



A HILL OF THE TRINIDAD DASHEEN GROWN FROM A SINGLE TUBER 6 MONTHS FROM PLANTING.

The plant is $5\frac{1}{2}$ feet tall and has a spread of more than a square yard. One hill will produce on good, rich soil 4 to 10 pounds or more of tubers.



A 3-POUND DASHEEN CORM, A GOOD SIZE FOR TABLE USE.

The corm and the tubers (see Plate IV) contain 50 per cent more protein and starch than the potato and have a decidedly nutty flavor when baked or boiled. The corms have been forced in greenhouses during the winter for the production of their delicate-flavored, blanched shoots. (About three-fourths natural size.)



DASHEEN TUBERS FOR TABLE USE.

The corm is surrounded by these tubers, large and small, in a compact cluster. An excellent flour has been made from both corms and tubers for use in combination with wheat flour for griddlecakes, bread, etc. (Two-thirds natural size.)

in this way even in the case of tubers that are not acrid to the taste. If water is not used while scraping them, it is best to wash the hands afterwards in soda water of the strength mentioned.

The dasheen corms and tubers¹ (Pls. III and IV) are similar to the potato in composition, but they contain less water, and in consequence the content of starch, as well as of protein, is roughly a half higher than in the potato.² In addition, they possess a very agreeable nutty flavor. Remarkable digestibility has long been attributed to the aroid tubers, and in Hawaii, as well as in other countries where they are grown, their use for invalids is often prescribed. The starch grains of the taro and dasheen are among the smallest known in all food plants, and this is thought by some to account in part for the ease of digestion.

RESULTS OBTAINED IN CULTIVATION.

Experiments in growing the dasheen on a small scale have been made at a number of points in the Northern States, even as far north as New York, but while tubers were usually produced they were comparatively small. The reports received do not at present warrant the Department of Agriculture in recommending dasheens for cultivation generally, even in vegetable gardens, north of the Carolinas. Future experiments, however, may show that this limit can be extended.

The first marked success in the experimental growing of dasheens in this country was in 1909 in South Carolina, to which reference has already been made. Forty bushels were harvested from one-tenth of an acre. The next year the propagation of the dasheen was begun at the Plant Introduction Field Station, Brooksville, Fla., but it was not until the season of 1912 that a crop large enough for a wide distribution was raised. Seven acres were grown that season, though more than 2 acres of this were on what proved to be very unsuitable land. The clay subsoil came almost to the surface in many places and in others formed "pockets," which held the excessive rainfall, to the detriment of the plants. A total yield of about 1,200 bushels was obtained.

The results for the year 1913 at the Brooksville station were much better than for the preceding year. The yield of dasheens was about 1,400 bushels from slightly less than 5 acres, or an average of 296 bushels per acre. Several cooperators in Louisiana and Florida reported weights of 18 to 22 pounds of dasheens from single hills.

¹ Each hill of dasheens contains one or two rather large, somewhat spherical corms, around which develop numerous cormels. The latter are popularly called "tubers." For the corm, however, because of the differences in size and form between it and the cormels, it is found convenient to retain the technical name in common usage. The word "tubers" is also used occasionally in a loose sense to include both corms and cormels.

² An average of 11 analyses of dasheens by the United States Department of Agriculture gives 27½ per cent of carbohydrates (starches and sugars) and 3 per cent of protein. For the white potato the generally accepted figures are 18 per cent of carbohydrates and 2.2 per cent of protein. The sweet potato approximates the dasheen in carbohydrates, but it is even lower than the white potato in protein.

Of these quantities, approximately one-third consisted of marketable tubers (Pl. IV), one-fifth or more of corms (Pl. III), one or two of which occur in each hill, and the remainder, nearly one-half, of small tubers, which were mostly distributed for planting. About one-half of these small tubers would be large enough for the home table, but are too small for the market.

The smallest tubers are not altogether satisfactory for seed purposes and may better be used for stock food in connection with other foods. While reports have been received showing that cattle and hogs eat dasheens, raw or cooked, with relish, no careful experiments have yet been made in this country¹ upon which to base definite statements relative to the use of dasheens for stock food.

In the season of 1913 dasheens were successfully grown by co-operators at Norfolk, Va., Ray, Ariz., and at Indio and other points in the desert regions of southern California—at the Arizona and California points under irrigation. The growth of the plants does not appear to be seriously retarded by the hot, dry atmosphere of the desert if abundant moisture is present in the soil. Further experiments will be necessary, however, to determine fully the possibilities of the crop in these irrigated sections.

USES.

The corms, which sometimes reach a weight of more than 6 pounds each, are usually of a quality fully equal to the tubers and are excellent when baked, though occasionally one is found that, even when thoroughly cooked, proves a little too firm to be palatable. It is believed, however, that this undesirable character can be eliminated by using for planting tubers from such plants only as produce corms of satisfactory quality.

The corms may be converted into flour, which can be made into soups and gruels. Dasheen flour when used with wheat or rye flour makes most delicious griddlecakes, biscuits, and bread. The griddlecakes do not become heavy by standing. Some 3,000 pounds of flour were produced during the season of 1912-13 from 200 bushels of corms and tubers. This flour was used experimentally by co-operators in cooking and baking.

Dasheen corms may also be forced² with bottom heat in a greenhouse, and the blanched shoots, by special cooking to remove the acidity, may be used like asparagus. The shoots are very tender and have a delicate flavor, suggestive of mushrooms. There are probably few plants so well suited for forcing purposes as the dasheen. Experiments carried on at the greenhouses of the Department of Agri-

¹ See United States Department of Agriculture, Bureau of Plant Industry Bulletin 164, entitled "Promising root crops for the South," p. 16.

² A circular giving directions for the forcing and blanching of dasheen shoots will be sent by the United States Department of Agriculture without charge, upon request.

culture at Washington in 1912 and in those of the Battle Creek Sanitarium at Battle Creek, Mich., early in 1913 indicate that five to eight crops of these delicate shoots can be harvested. The first cutting can be made in 35 to 40 days after the corms are set in the sandy soil of the greenhouse bench, and subsequent ones at intervals of 10 to 14 days.

The tops of corms not utilized in any of the ways mentioned may be used the succeeding season for planting, and the basal part—a half or more—may be used for the table or for stock food.

While all of the tuberous growth of the dasheen is edible, the medium-sized or large tubers are especially adapted for use like potatoes. The corms are usually drier and more mealy than the tubers, however, and by many persons are preferred to the tubers for boiling or baking, but until a pure strain, free from the occasional objectionable quality previously referred to, has been developed, the medium-sized tubers will probably constitute the principal value of the crop on the market. The corms do not usually keep as well as the tubers, and it is therefore advisable to utilize them as early as practicable after harvesting.

CULTURAL REQUIREMENTS.

The dasheen requires rich, sandy soil, very moist but well drained. The plant will not be greatly injured by occasional flooding for a short period. Such lands as the so-called hammock lands of Florida are especially adapted for the cultivation of this crop. Any low-lying sandy land that is fairly well drained, but still too wet for general field crops, can be used to advantage. On these low lands it would be advisable to plant on ridges.

While dasheens often yield heavily in muck soils, the tubers are very inferior in quality under these conditions and are scarcely fit for table use. For the manufacture of flour or starch, for forcing for the shoots, or for stock food, however, such dasheens are apparently satisfactory.

Planting should be done as early in spring as the conditions of soil and climate will permit. This may be as early as the first of February in southern Florida and as late as the last of March or the early part of April in the Carolinas. In these more northern latitudes, where the season may be a little short, it will often be advisable to start the tubers in moist sand or soil, under cover, two to three weeks earlier.

Preliminary experiments indicate that it does not pay to use very small dasheens for planting if larger tubers are available, as this may result in the yield being reduced by as much as 15 per cent. Tubers

of 3 to 5 ounces in weight are preferable for planting. For field culture the tubers, unless very small or very large, are planted, singly and entire, not more than 2 to 3 inches deep in hills 3 feet apart, the distance between rows being 4 feet. This will permit horse cultivation. In cultivating during the summer the soil should be gradually drawn to the plants and the ground kept free from weeds; they usually require little cultivation after becoming large enough to shade the ground. Well-grown plants will reach a height of $4\frac{1}{2}$ to 6 feet or more by midsummer. Mulching, where practicable, will help to conserve the soil moisture and keep down weeds.

The crop matures in about seven months, although the tubers can be utilized for home use in six months or less from planting. The harvesting of the main crop may be deferred a month or two if desired, but if it is to be done at one time, in order to have warm, dry weather for the dasheens to dry properly on the ground, it should not be delayed until there is danger of frost. For this reason it will usually be best to harvest dasheens some time in October. It will sometimes prove advantageous in practically frost-free localities or where the roots can be protected to leave them in the ground until wanted for use or until spring.

Where soil and climatic conditions are favorable, dasheens will produce from 4 to 10 pounds or more to the plant. Under experimental conditions at Brooksville, Fla., in different soils and in different seasons, the Department of Agriculture has secured yields ranging from 140 to 450 bushels to the acre. Satisfactory results have not been obtained, even in good soil, when two successive crops of dasheens are grown on the same ground.

The growing of a dasheen crop is probably no more expensive than that of a potato crop. Although the season for the dasheen is much longer than that for the potato, the large leaves of the former tend by shading to keep down weeds after midseason.

FERTILIZER.

Experiments made at the Porto Rico Agricultural Experiment Station¹ indicate that ordinary stable manure is better suited than commercial fertilizer for use in growing dasheens and other plants of this kind. Where there is a deficiency of potash in the soil, however, as in most of the sandy soils of the South, and especially where stable manure is not available, a fertilizer containing 10 to 12 per cent of potash should be applied. From 600 to 1,000 pounds to the acre may be used, the quantity depending upon the state of fertility of the soil. The fertilizer should be applied within a few weeks after planting, and a second application may be desirable in midsummer in some instances.

¹ See United States Department of Agriculture, Bureau of Plant Industry Bulletin 164, entitled "Promising root crops for the South," p. 12.

HARVESTING.

Harvesting, for the present at least, is more costly than for potatoes, because of the hand labor required in separating, cleaning, and sorting the tubers. A 10-inch plow has proved satisfactory for turning the plants over when the area grown is large enough to justify its use. Even on sandy land, however, the numerous fibrous roots hold the soil so firmly that a clump of tubers can not be separated except by hand. The plants should be grasped by the tops and the clumps thoroughly shaken to dislodge as much of the soil as possible. They can then be broken apart by means of the tops, and in dry weather the tubers, with tops still attached, should be left on the ground to dry for four to six days.

It is highly desirable to harvest the crop during a dry spell, as it is of the utmost importance that the tubers have time to dry well in the open air before being stored. The tubers should not in any case be exposed to frost.

GRADING.

The grading of dasheens is of primary importance, especially where the grower wishes to build up a market among hotels and other discriminating consumers. The first grade should contain only perfect tubers of uniform size and shape, weighing approximately 4 to 5 ounces each (Pl. IV). Some mechanical means of grading can no doubt be devised that will materially lessen the cost of handling. A very simple scheme where the quantity of dasheens is not too large is to make a wooden frame, say, 18 by 24 inches and 6 inches deep, with a bottom of parallel rounded slats or wooden rods at suitable distances apart. Rods of the diameter of a rake handle or slightly less will probably be found most satisfactory.

For separating tubers too small for market, the distance between the rods should be about $1\frac{3}{4}$ inches. A frame of the size mentioned can be readily handled by one man. If, however, the quantity of dasheens is large it will be desirable to have a stationary grader of larger dimensions. It should be placed on an incline, so that the larger tubers will roll off at the lower end. If more than two grades of tubers are desired, an additional set of rods or bars at either greater or less distances apart can be placed a few inches above or below, as may be necessary. In the use of any grading device and in the handling of dasheens generally, care should be taken, as in handling potatoes, not to bruise them.

On account of the variability in the form of dasheen tubers some handwork will probably always be necessary where careful grading is required, but the amount of this can be greatly reduced by adopting some plan like one of those outlined.

STORAGE.

The question of the best method of storing dasheens to prevent them from decaying is still under investigation. At present they appear to be no more difficult to keep in storage than sweet potatoes. They will usually keep well if stored in a dry place at a temperature of about 60° F. where the air can circulate freely among them. It is believed that they will also keep if placed in dry sand or earth in a dry cellar having a temperature of 60° F. or a little less. A cooperator having but a limited quantity of dasheens has reported excellent results from storing under cover the entire clumps, with the adhering soil and the bases of the leafstalks still attached, filling the spaces between with soil. Both corms and tubers kept perfectly until spring.

CONCLUSIONS.

From the interest that has already developed among southern farmers who have become even slightly acquainted with the dasheen, it seems probable that this crop is destined to be of great importance to that section of the country. It can be grown as a summer crop in a region where the potato must be grown almost entirely as a spring crop, for it ripens its tubers in October and furnishes them for the table at a season when northern-grown potatoes have to be shipped in, at prices relatively high except in seaports. It has been demonstrated that it can be grown with at least a fair degree of success in the irrigated sections of the Southwest. It is a good yielder, comparing favorably with the potato. If grown on well-drained land it is not injured, as the potato is, by unusually wet weather, and it is therefore suited for cultivation on lands where the potato would be a failure. Its culture on wet lands in the South where the water supply can be controlled by drainage or otherwise is a subject of further investigation.

The young leaves *when properly cooked* can be substituted for spinach at a time when the weather is too hot to grow spinach. The blanched shoots obtained by forcing dasheen corms in the dark in a greenhouse or under other suitable conditions constitute an entirely new product, which is meeting with general approval. The nutty flavor of the tubers gives them a peculiar palatability, which has struck the fancy of many people. The higher nitrogenous and starchy content gives them an advantage as food that would seem to make the plant, when compared with the potato, an even more valuable food producer.

RECIPES FOR THE PREPARATION OF THE DASHEEN.

This vegetable is a staple article of food for millions of people in tropical and subtropical countries. In general, it is used in the different ways in which the white potato and the sweet potato are

used. The flesh of the large, spherical corms and of the larger tubers (which are usually much smaller than the corms) is frequently somewhat gray or violet when cooked, but this does not affect the flavor.

If uncooked dasheens are scraped or pared they should be handled in water to which a level teaspoonful of sal soda to the quart has been added, in order to prevent irritation to the hands.

BAKED DASHEENS.

Dasheens, large or small, may be baked like potatoes, in a quick oven. They should first be washed and scrubbed to remove the fibrous part of the skin. When practicable to do so it is often desirable to scrape the dasheens before baking, as they are then more convenient for eating and the soft crust which forms when they are properly baked is particularly delicious. Rubbing with fat before baking will improve them. The corms may be cut in half from top to base, in order to lessen the time needed for baking. They should be parboiled for 10 to 20 minutes, whether scraped or not, unless rubbed with fat. The time required for cooking is about the same as for potatoes of the same size. They should be served immediately when done. Season with salt and plenty of butter, and pepper if desired. Gravy may be used in place of butter.

The dasheen when properly baked and served is mealy, and the flavor is much like that of the white potato, but more or less suggestive of chestnuts. As the dasheen is drier than the potato it requires more butter.

STUFFED DASHEENS.

Proceed the same as in baking, and when the dasheens are done follow the method used for stuffed potatoes, using more butter, however. If cream instead of milk is used for moistening, still better results are secured.

The corms are especially adapted for serving in this manner, but they should always be scraped and, unless quite small, may be cut in half. Instead of mashing dasheens it will always be found better to rice them with a potato ricer or to rub them through a coarse sieve.

SCALLOPED DASHEENS.

Pare raw dasheens and slice thin, putting in layers in a well-buttered baking dish and seasoning each layer with salt and butter. Nearly cover with rich milk and bake.

This method of serving the dasheen will be found particularly well adapted for banquets or formal dinners, but in such cases individual baking dishes or casseroles should be used.

The above recipe may be varied by using less butter and adding grated cheese. Pepper may also be used in seasoning if desired. Cold boiled instead of raw dasheens may also be utilized, but the results will usually not be so good. Corms should not be used for scalloping if small or medium-sized tubers are available.

BOILED DASHEENS.

Large dasheens are preferable for boiling, though small ones may also be used. They should be boiled in the skin and may be served thus, or the skins may be removed before serving. Dasheens should not be boiled longer than potatoes of the same size, and generally they should not be pared before boiling.

FRIED DASHEENS.

Slice boiled dasheens, either warm or cold, into thick, even slices, season with salt, and fry quickly in plenty of fat.

Boiled dasheens, while still hot, may also be mashed or put through a potato ricer, mixed with grated cheese, and made into cakes or croquettes and fried. The cheese may be omitted and the croquettes dipped in egg and cracker crumbs before frying.

Excellent griddlecakes are also made by using one part of grated raw dasheen to two or three parts of wheat flour, with the other ingredients as usual.

MASHED DASHEENS.

On account of the somewhat mucilaginous character of dasheens they are not recommended for mashing in the ordinary way. They do, however, make an excellent dish when boiled in the skin, peeled, and riced, or put through a sieve, as previously mentioned. Rich milk or cream and a liberal quantity of butter should be used in seasoning when particularly good results are desired. It should be remembered that riced or mashed dasheens may be a little dark, especially when corms or large tubers have been used.

CREAMED DASHEENS.

Boil the dasheens in the skin and proceed as for creamed potatoes.

DASHEEN SALAD.

Boil medium-sized or small dasheens in the skin and proceed as for potato salad. It is very important to prepare the dasheens while still warm and to add the dressing at once.

DASHEENS AS FILLING FOR FOWL AND OTHER MEATS.*

- 2 cups of riced dasheen.
- 1 cup of bread crumbs.
- 1 egg.
- 2 tablespoonfuls of butter.
- Season to taste with salt, pepper, sage, and onion.

The dasheens should be boiled and riced in the usual way.

DASHEEN SOUP.

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| 3 cups of boiling water. | 3 tablespoonfuls of butter. |
| 3 cups of milk. | Salt and celery salt to taste. |
| 3 cups of riced dasheen. | Parsley or grated onion if desired. |

Boil and rice the dasheens as described. Into a double boiler put the boiling water and add the milk and dasheen. Bring to a boil and cook for 5 to 10 minutes. Season and serve.

CANDIED DASHEENS.

Peel parboiled dasheens and cut into thick slices or strips. Prepare a sirup made in the following proportions:

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| 1 cup of sugar. | 2 to 3 tablespoonfuls of butter. |
| 2 cups of hot water. | Salt if desired. |

Either granulated or brown sugar may be used. Cinnamon may be added if desired. Boil in this sirup in a covered dish until soft, and brown in the oven.

DASHEEN PIE.

Any recipe for sweet-potato pie will probably do, but the following is suggested as being economical and otherwise satisfactory. The dasheens should be boiled and riced as usual.

2 cups of riced dasheen.	$\frac{1}{2}$ teaspoonful of nutmeg.
$\frac{1}{4}$ cup of butter.	1 egg (white and yolk beaten separately).
$\frac{3}{4}$ cup of white sugar.	2 cups of milk.
$\frac{1}{2}$ teaspoonful of cinnamon.	$\frac{1}{2}$ lemon, juice and rind.

Bake in a deep pie tin. Serve warm.

DASHEEN PUDDING.

Proceed the same as with the above recipe for pie. Bake without crust in a deep dish well buttered.

DASHEEN SHOOTS.

1. Cut the blanched shoots into 2-inch lengths, pour on an abundance of boiling water, add salt, and boil for 12 minutes; drain, pour on enough cold ¹ milk so that the shoots will be completely covered when it boils, season with salt, and boil for 5 minutes; drain, season with butter, and serve on toast or plain. It is well to add a little butter to the milk, in boiling. Cream sauce may be used in serving if desired.

2. Instead of boiling in milk after draining off the first water, add a little piece of bacon or other fat meat ² and then cover the shoots with cold water, season with salt, and boil for 5 minutes. Drain and serve.

DASHEEN GREENS.

The young leaves of dasheens and other plants of this class are used for greens, like spinach, in all countries where these crops are grown. The leaves not yet unrolled are better than the open ones. *They should never be tasted raw.*

Remove half or more of the midrib of the leaf. Boil the leaves for 12 to 15 minutes in water to which a good pinch of baking soda has been added. Drain off the soda water, wash with clear boiling water, and then boil in water seasoned with salt for 20 to 30 minutes, or until tender. Other seasoning may be added as desired.

The above treatment destroys the acidity, but boiling in soda water has been found unnecessary when the greens are cooked with fat meat.

Approved:

WM. A. TAYLOR,
Chief of Bureau.

AUGUST 25, 1914.

¹ The purpose in using cold milk or water after the first boiling is to prevent the shoots from becoming too soft.

² The fat of the milk or meat seems to assist in destroying the acidity.

